REMARKS

Claims 1-48 are pending in this application, of which claims 26-30 and 41-48 have been withdrawn from consideration. Claims 1, 5, 6, 9 and 10 have been amended. No new claims have been added.

The Examiner has required a new, more descriptive title. The title has been so amended.

Claims 1-25 and 31-40 stand rejected under 35 U.S.C. § 103(a) as unpatentable over JP-2002006352 to Shimoyama (hereafter "**Shimoyama**") and U.S. Patent 6,693,937 to Steffens (hereafter "**Steffens**").

Applicants respectfully traverse this rejection.

(1) The Examiner urges there are the following correspondences between the constituents of the present invention and the parts 6, 4 and 3 of the variable wavelength conversion device disclosed in **Shimoyama**: the light oscillation part and the light amplification part of all claims correspond to the parts 6 and 3, respectively; the current leading-out part of claim 31 and its dependent claims correspond to part 4. The Examiner admits that **Shimoyama** discloses neither the oscillation part nor the light amplification part using current injection and the structure claimed.

First, Applicants respectfully submit that the Examiner's interpretation of the device parts disclosed in **Shimoyama** is in error, as described in detail below.

First, part 6 of the device disclosed in **Shimoyama** is irrelevant to the light oscillation part of the present invention. Part 6 is a waveguide with a wavelength filtering function, which

includes a distributed Bragg reflector 7. Waveguide 6 of **Shimoyama** works as a mere wavelength filter, endowed with no controlling function of filtering wavelength. On the other hand, the light oscillation part of the present invention has a particular structure in which the active layer and the tuning layer (the wavelength controlling layer) is formed above the first conduction-type semiconductor substrate, with the second conduction-type intermediate layer intervening between the active layer and the tuning layer. The light oscillation part of the present invention generates laser light by itself. To the contrary, waveguide 6 of **Shimoyama** is a passive optical element which never generates light by itself, but simply filters light without controlling filtering wavelength. It is evident that waveguide 6 of **Shimoyama** has nothing to do with the light oscillation part of the present invention. Thus, the waveguide 6 with filtering function of **Shimoyama** does not correspond to the light oscillation part of the present invention.

Secondly, part 4 of the device disclosed in **Shimoyama** is irrelevant to the current leading-out part of the present invention. Part 4 of **Shimoyama** is an optical coupling waveguide which couples light from the end face emission type semiconductor laser waveguide 1 and the first semiconductor optical amplification waveguide 3 to the second semiconductor optical amplification waveguide 5. Naturally, the waveguide 4 includes no electrical switch which relates to the current leading-out. **Shimoyama** neither discloses nor suggests the current leading-out by the waveguide 4. The waveguide 4 is a passive optical element which has nothing to do with the current leading-out. As claimed, the current leading-out part of the present invention selectively leads out current injected into the active layer or the tuning layer from the

intermediate layer. Thus, the waveguide 4 of **Shimoyama** is irrelevant to the current leading-out part of claim 31 and dependent claims 31-40 of the present invention.

As discussed above, it is respectfully submitted that the Examiner's argument regarding the correspondence between the constituents of the present invention and the parts of the device disclosed in **Shimoyama** is unreasonable and grounded on the misunderstanding about the device disclosed in **Shimoyama**. It is impossible to apply the current injection and the structure of the tunable laser taught by **Steffens** to the waveguide 6 of **Shimoyama** because both are substantially different optical elements from one another. **Shimoyama** does not disclose or suggest the current leading-out part of the present invention. Therefore, the present invention according to claims 1-25 and 31-41 would not have been obvious to one of ordinary skill in the art at the time the invention was made.

(2) **Shimoyama** discloses the wavelength variable laser 2 monolithically formed with the semiconductor optical amplification waveguide 3 (5). The wavelength variable laser 2 is not of TTG (tunable twin guide) laser type but might be arrayed DFB lasers, each of which has a fixed oscillation wavelength. What follows are the arguments that the present invention still would not have been obvious even if the current injection and the structure taught by **Steffens** were applied to the wavelength variable laser 2 and the semiconductor optical amplification waveguide 3 (5) of **Shimoyama**.

(A) Regarding claims 1-15

The present invention, according to amended claim 1, recites a technical feature regarding the electrode arrangement that one electrode for leading out current from the light amplification part is positioned at the side surface of the mesa stripe of the light amplification part. This electrode arrangement makes it possible to commonly use electrodes for leading out current formed on the same side of the semiconductor substrate, while the wavelength variation control in the TTG laser part and the light amplification control in the SOA (semiconductor optical amplifier) part are performed independently of each other. Namely, the electrode of the SOA part for leading out current and the electrode of the TTG laser part for leading out current can be commonly used with the independent controls of the SOA part and the TTG laser part. Regarding this technical benefit, the specification states at page 24, lines 16-18 that "the electrode 52 may be formed in one pattern continuous to the electrode 50 of the TTG laser part."

As an individual device, a TTG laser and a SOA need several electrodes for their control, respectively. Specifically, three electrodes are required for a TTG laser to perform the laser oscillation control and the oscillation wavelength control. Two electrodes are required for a SOA to perform the light amplification control. Accordingly, when a TTG laser and a SOA are integrated on the same substrate, it is an essential problem how to design the specific arrangements of electrodes for the controls of the TTG laser and the SOA, aside from the electrode arrangements for the individual

TTG laser and SOA.

The present invention according to claim 1 has the feature in connection with the arrangement of the electrode for the control of the light amplification part. That is, the electrode arrangement is specially designed for the light amplification part (SOA) integrated with the light oscillation part (TTG laser) on the same substrate. The electrode arrangement of the present invention is anything but a simple arrangement of an individual SOA. Thus, the present invention according to claim 1 does not correspond to a simple combination of a TTG laser and a SOA. It is apparent that neither **Shimoyama** nor **Steffens** teach the specific arrangements of electrodes when a TTG laser and a SOA are integrated on the same substrate. Accordingly, the present invention according to claims 1-15 would not have been obvious to one of ordinary skill in the art at the time the invention was made, even if the current injection and the structure taught by **Steffens** are applied to the wavelength variable laser 2 and the semiconductor optical amplification waveguide 3 (5) of **Shimoyama**.

(B) Regarding claims 16-25

The present invention, according to claims 16-25, recites an insulation layer formed between the semiconductor substrate and the optical waveguide layer in the optical waveguide part, the optical waveguide part being formed together with the light oscillation part of tunable twin guide laser diode (TTG-LD) structures. The insulation layer of the present invention according to claims 16-25 corresponds to the rectifying

layer 180 in the ninth and the eleventh embodiments or the semi-insulating semiconductor layer 212 in the tenth embodiment.

When the light oscillation part of TTG-LD and the optical waveguide part are integrated monolithically on the same semiconductor substrate, the semiconductor substrate and the optical waveguide layer are insulated from each other by the insulation layer in the present invention. Accordingly, the generation of leak current between the semiconductor substrate and the optical waveguide layer can be suppressed during the current injection in the light oscillation part. As a result, the current injection can be performed with high efficiency in the light oscillation part.

Both **Shimoyama** and **Steffens** fail to disclose or suggest the insulation layer of the present invention according to claims 16-25. Therefore, the present invention would not have been obvious to one of ordinary skill in the art at the time the invention was made even if the teachings of **Shimoyama** and **Steffens** were combined.

(C) Regarding claims 31-40

As discussed above, part 4 of **Shimoyama** is a mere optical waveguide which has nothing to do with the current leading-out. **Shimoyama** does not disclose or suggest the current leading-out part of the present invention according to claims 31-40. It would not have been obvious to one of ordinary skill in the art at the time the invention was made even if the teachings of **Steffens** were applied to the device disclosed in **Shimoyama**.

Thus, the 35 U.S.C. § 103(a) rejection should be withdrawn.

In view of the aforementioned amendments and accompanying remarks, claims 1-25 and 31-40, as amended, are in condition for allowance, which action, at an early date, is requested.

If, for any reason, it is felt that this application is not now in condition for allowance, the Examiner is requested to contact Applicants' undersigned attorney at the telephone number indicated below to arrange for an interview to expedite the disposition of this case.

In the event that this paper is not timely filed, Applicants respectfully petition for an appropriate extension of time. Please charge any fees for such an extension of time and any other fees which may be due with respect to this paper, to Deposit Account No. 01-2340.

Respectfully submitted,

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Enclosures: Substitute Sheet for Abstract
Petition for One Month Extension of Time

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